



**Kansas Department of Health and Environment (KDHE)  
Information Paper Addressing the Potential  
for Class I Disposal Well  
Operations in Kansas to Cause Earthquakes**

**UICI-IP-1**

(02/12)

**CONCERN**

Question: Do Class I disposal wells in Kansas have the potential to cause earthquakes?

KDHE Response: The potential is very minimal. This is because of the geologic setting of Kansas along with the requirements placed on Class I disposal wells by the Kansas Department of Health and Environment (KDHE) through the Underground Injection Control (UIC) Program.

Several definitions are necessary to better understand the information provided in this document.

**DEFINITIONS**

Fault: a rupture of the rock along which there has been differential movement.

Earthquake: seismic energy released by the sudden movement of rocks along a fault.

Well: a bored, drilled or driven shaft that is deeper than it is wide which has been constructed to move fluids out of or into the subsurface.

Injection: the subsurface emplacement of fluids through a well.

Injection well: a well into which fluids are injected.

Class I disposal well: an injection well used for the disposal of hazardous or non-hazardous industrial waste fluid into a geologic zone beneath the lowermost usable water (less than 10,000 mg/l total dissolved solids) bearing zone. The injection zone is separated from the usable water zone by thousands of feet of impermeable rock which protects the usable water zone.

**DISCUSSION:**

Earthquakes occur because rock formations move against one another at fault locations. Sometimes earthquakes occur from the natural movement of rocks, and sometimes human activities may encourage, or induce, the movement of rocks. One activity that may induce earthquakes is underground injection, which is one of the reasons why KDHE regulates Class I injection wells. KDHE ensures wells operate in a manner that protects the environment and the public health.

The geology of Kansas and KDHE oversight of well operations decrease the probability that Class I disposal wells may cause earthquakes.

The geologic conditions present in Kansas that significantly reduce the potential for injection induced earthquakes are as follows:

- The Arbuckle Formation is the preferred disposal formation that meets KDHE requirements because it is a thick, permeable and porous formation which limits pressure build-up in the formation that might cause earthquakes. Forty-six of the 47 active Class I disposal wells in Kansas use the Arbuckle as the disposal formation.
- The Arbuckle Formation is a relatively simple rock formation geologically and documented faults in the Arbuckle Formation are limited in extent.

- Typically, Kansas experiences a few measurable earthquakes (magnitudes greater than 1.7) and very rarely produces felt earthquakes (magnitude greater than 2.5). Historical earthquake information collected by the Kansas Geological Survey and the United States Geological Survey confirms this limited activity. There have been no indications of any earthquake resulting from injection into a Class I disposal well.

Class I disposal wells are the most strictly regulated type of injection wells. These wells must meet the requirements of the U.S. Environmental Protection Agency and the Kansas Department of Health and Environment.

The regulatory requirements implemented by KDHE that significantly decrease the potential for Class I disposal well operations to cause earthquakes include the following:

- KDHE does not allow well operators to inject fluid using surface pressure. KDHE regulation K.A.R. 28-46-28 and the UIC permits issued by KDHE limit injection to “gravity” at the surface and pump pressure is not allowed. Gravity injection allows only the amount of fluid to be injected that the formation can naturally accept thereby limiting pressure build-up in the disposal formation reducing the potential of rock movement at a fault. Any pressure increases that do occur from injection are limited to the vicinity of the well, which also decreases the likelihood that injection fluids would travel far enough from the well to encounter a fault and cause earthquakes.
- KDHE regulation K.A.R. 28-46-28 limits injection pressure to below the rock fracture pressure. This prevents the injection from fracturing the rock or opening up fissures which could activate a fault.
- KDHE requires operators when applying for a permit to install an injection well to identify faults near the well. KDHE regulation K.A.R. 28-46-32 requires the injection well owner/operator to conduct an Area of Review (AOR) for injection wells of a minimum of 1 mile radius around the well location for non-hazardous injection and a 2.5 mile radius for hazardous waste injection wells. Any faults within this area must be identified and evaluated for potential impact by the injection operation. If potential adverse impacts are identified, then adjustments are made by KDHE to the requirements for the injection well.
- KDHE regulation K.A.R. 28-46-31 requires an extensive geologic evaluation of a Class I disposal well site as part of the permit application process. This evaluation includes determining whether faulting is present and that the proposed disposal zone will not experience undesirable over-pressuring which can activate a fault or cause fracturing of the rock.
- KDHE monitors the added pressure that injection causes in the formation and adjusts the requirements for well operators as needed to be protective. The disposal formation is tested annually using the formation pressure fall-off test which measures down hole injection formation pressure as required by KDHE regulation K.A.R. 28-46-30. The results of this test are evaluated to determine a number of injection formation conditions, including pressure anomalies that could indicate the presence of a fault. These tests have found no indication of faults in the zone of influence of the Class I wells located in Kansas.

### **CONTACT INFORMATION:**

If more information is needed, please contact the KDHE Geology Section at 785.296.5524.